

National Aeronautics & Space Administration
OFFICE OF BIOLOGICAL & PHYSICAL RESEARCH

BIOLOGICAL & PHYSICAL RESEARCH
ADVISORY COMMITTEE MEETING

February 13–14, 2003
NASA Headquarters, Washington, DC

MEETING REPORT

Bradley Carpenter
Executive Secretary

Kenneth M. Baldwin
Chair

**Biological & Physical Research Advisory Committee
NASA Headquarters, Washington, DC
February 13–14, 2003**

**Meeting Minutes
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Biological & Physical Research Advisory Committee**NASA Headquarters, Washington, DC****February 13–14, 2003****Thursday, February 13, 2003****WELCOME—Dr. Baldwin**

Dr. Baldwin, Chair of the Biological and Physical Research Advisory Committee (BPRAC), called the meeting to order and welcomed participants. A moment of silence was observed for the crew members of the *Columbia* who gave their lives for science.

REVIEW OF BPRAC RECOMMENDATIONS—Dr. Carpenter

Dr. Carpenter reported on the status of BPRAC recommendations presented at the August meeting, the last meeting of the entire group. The NASA response to most of the recommendations would be within presentations given at this meeting. The recommendations and the NASA response were as follows:

- The REMAP report has provided the NAC and NASA with a prioritization of research to be carried out on the ISS that is based uniquely on scientific merit. There has been significant dissent from within the REMAP Committee concerning the report, and the BPRAC is concerned as to the nature of this dissent and as to how the NAC and NASA will integrate the dissent into implementation plans. A public response to the REMAP committee dissent should be an integral part of the NAC and NASA reactions to the REMAP report. *Response: Program Overview briefing this meeting*
- The REMAP report provides the NAC with a prioritization of research to be carried out on the ISS that is based on an evaluation of scientific merit. The NAC will review this report and pass on to NASA a final set of recommendations on ISS research priorities. The mechanisms through which NASA will implement these scientific priorities within the constraints of the capabilities of the ISS (at core complete, and beyond) are not yet defined. For example, absence of the plant and animal habitat and lack of the large rotor centrifuge would severely constrain the types of experiments that could be accomplished. Until an ISS configuration equivalent to the Rev F ISS assembly is achieved, the complete program objectives cannot be met on ISS. NASA should balance the scientific priorities against probable ISS capabilities (crew resources, facilities, up-mass capabilities, ISS lifetime, etc.) so as to optimize overall scientific yield. In doing so, NASA should seek continuing guidance from the scientific community. NASA is also encouraged to develop new strategies and initiatives for achieving OBPR scientific goals aboard the ISS. *Response: Program Overview briefing this meeting*
- Commercial space development activities in NASA are increasing. These activities occur in many parts of the NASA organization and lack central policy guidance and coordination. Moreover, individual PIs increasingly are seeking to establish business relationships with private sector investors without uniform guidance from NASA on appropriate legal matters such as patents, licensing, trademarks, and procurement. The NASA Administrator should address the status of the commercial programs and develop standard policies and coordinate them. The assistant to the administrator for Commercial Development should have designated staff co-located in field centers and headquarters offices throughout the Agency to facilitate communication and cooperation in all these endeavors. *Response: Program Overview/ Space Product briefings this meeting*
- The NASA Advisory Council (NAC) has chartered the Research Maximization and Prioritization Task Force (REMAP) to identify and establish scientific research priorities for the OBPR/Agency. The key element for success of the ISS program is the effective utilization of science. REMAP has recommended that for each ISS increment one crew member should be designated as the “Science Officer.”
- The BPRAC endorses the designation of a “Science Officer” to drive the importance of science to the ISS. The Science Officer would strengthen the science priority and provide the basis for increasing

productivity. The roles and responsibilities of this new designation must be clearly defined to guarantee that overall science utilization is increased. *Response: ISS Research Status briefing this meeting*

- When redistributing limited financial resources within the Physical Sciences at OBPR, decisions are now being made that trade off funding of new or continuing peer-selected research projects against the completion schedule of key ISS facilities. The impact of these decisions will result in a dramatically reduced funding rate of proposals solicited in 2001/2002 NRAs and may impact FY04 funding rates. If this strategy continues, it will have a destabilizing effect on OBPR's research community. OBPR should return to a strategy in which research funds are protected against the last-minute financial stresses of ISS facility implementation. *Response: Division briefings this meeting*
- Although the ISS is the primary research platform, completing the research portfolio of OBPR may lend itself to synergistic activity on complementary platforms. A significant impediment to the development of the OBPR scientific and commercial research program is limited access to space for experiments. As a result, ways to increase access to space are critically needed, and the BPRAC strongly supports the efforts of OBPR to consider the use of new space platforms for experiments, e.g., OBPR Explorer missions patterned after OSS Explorers using free-flying spacecraft. BPRAC requests further briefing about OBPR plans concerning Explorer missions and the potential use of free flying spacecraft as new platforms for OBPR experiments in space and requests a briefing about the quality of the environment and type of experiments, budgeting, impacts on station research, and alternatives at its next meeting. *Response: Mission Integration briefing this meeting*
- BPRAC requests a briefing on the implementation of the IOM recommendations.
- BPRAC requests a formal presentation on the potential conflict between medical privacy and research data needs in projects involving astronauts. They also want regular reports on the Code M, Code AM, and Code U organization, function, and interaction. *Response: Briefing this meeting*
- The committee reaffirms its concern that consolidation of some 40 contracts into 7 will decrease prime contracting opportunities for small business, impede small organizations' access to OBPR research opportunities, and foster perceptions that NASA is a closed shop. The committee recommends that a status report be presented to members of the committee before the November teleconference. *Response: NASA Contracting strategy still being developed. Update provided in handout.*
- To prevent PIs from spending time on areas that are not being funded, OBPR should provide some estimate of either the funds anticipated to support a specific NRA or an estimate of the number of proposals likely to be supported at the time of NRA release. *Response: NRA's do provide an estimate of available funds. However, when those estimates change due to changes in the President's budget prior to its submission to Congress, we are generally unable to communicate detailed information to the research community until the budget is made public.*
- The committee fully concurs with the near-term (5 years) and the long-term (25 years) vision of Code U's role in the NEXT Initiative.

OBPR PROGRAM OVERVIEW—Ms. Kicza

STS-107 Accident

Ms. Kicza began with a discussion of the effects of the STS-107 mission. The mission was much anticipated, the scientific aspects went smoothly, and the crew worked well with the NASA community. NASA's priorities during these very difficult times are: first take time to grieve; second, fully support the investigation into the cause, and be sure hardware and software are secured and that control animals on the ground are dealt with; and third, recognize that as an agency we still have a mission and a vision that's intact, and that we must stay the course, learn from the accident, and move forward. Unique to the Code U arena was that questions were being raised about the value of the research being conducted and the necessity for human involvement. The Public Affairs Office met with the news media to express NASA's views and to explain what we're doing and why it's important. For future contact with the news media and general public, NASA needs to develop a product that BPRAC can review and strengthen. In addition to

dealing with the public, we must also maximize research utilization and opportunities for crew time despite delays in the space flights. It takes time to manifest payloads as well as to train people.

Discussion

Dr. Baldwin believes the news media aren't doing the job they should, and we need to counter this tendency both for the survival of scientific research and for NASA's image. After Dr. Jessup was interviewed, he found that his substantive points had been edited out, probably to suit a local audience; it's difficult to know how to deal with this. Dr. Bula saw that the negative PR was at the national level; at the local level (particularly in Madison) the press was very positive about continuing manned flights. Dr. Faeth cited the *Wall Street Journal's* negative statement; an astronaut rebutted it, but that rebuttal apparently hasn't appeared yet. However, Tuesday's Science Times section of the *New York Times* was very positive. Dr. Gross pointed out that people who want to give negative stories are just waiting for the kind of opportunity the disaster created. A number of investigators have asked Ms. Kicza what to say to present the issues positively. People should seek out opportunities to give good PR—you have to want to say it and choose to do it in your community. The silver lining is that the accident has catalyzed NASA to find better ways to communicate with the public.

Program Overview

Within the last year, OBPR has reorganized and begun filling senior leadership positions; Dr. Terry Lomax will direct the Fundamental Space Biology Division. A 5-year direction and 10-year research plan have been developed. Research priorities have been established; decision rules for continued research prioritization are being devised. The program management and strategic planning approaches have been defined. An ISS utilization approach has been established and a Shuttle/Station utilization reinvention effort initiated. February 2004 was the original Core Complete date for the ISS, but given the current Shuttle stand down we can't tell how that will change. Details are on the *spaceresearch.nasa.gov* website.

Overall, NASA is growing faster than most other agencies: the Biological Sciences Research Theme and the Physical Sciences Research Theme are both growing over the next 5 years, and the Research Partnerships and the Flight Support Theme remain stable. In 2004 the agency will transition to full-cost budgeting and management (i.e. including institutional costs, such as salaries and facilities, in total costs), which will require adequate reserves—20% for developing projects; 10% for sustaining projects. Throughout, NASA will reduce funding for low-priority projects and phase out those of lowest priority. Five flights per year will be supported, highlighting our orbital space capability with increased crew.

The NAC has recommended that OBPR further prioritize the ReMAP Task Force's category-1 research programs, and that OBPR identify and prioritize key scientific questions around which it can organize the management of its research portfolio. NASA needs to develop a multi-year temporally phased plan for ISS science in the U.S. Core Complete and the U.S. Core Complete plus International Partners configurations. NASA also needs to formulate an agency communications strategy. ISS research requirements and planning process has been scheduled from July through September 2003.

Organizing questions have been formulated to guide NASA's program planning. The Public Affairs Office will also use these questions as the basis of their communications strategy to articulate the ISS research objectives so they can be easily understood. OBPR will focus its sponsored research to answer these questions:

1. How can we assure the survival of humans traveling far from Earth?
2. What must we know about how space changes life forms, so that humankind will flourish?
3. What new opportunities can scientific exploration bring to enrich lives and expand our understanding of the Universe?
4. What technology must we create to enable the next explorers to go beyond where we have been?
5. How can we educate and inspire the next generations to take the journey?

NASA's exploration strategy uses a stepping-stone approach to prioritize the agency's current research over the next 10 and 25 years to ensure that the projects will further NASA's mission—to understand and protect our home planet; to explore the Universe and search for life; and to inspire the next generation of explorers. To further prioritize OBPR's ISS research, decision rules and metrics are being drafted. High-priority research—fundamental, strategic, or commercial—has been assessed for readiness to perform on ISS. Planning exercises have also categorized ISS research capability was also categorized on in a number of configurations: where it stands today, U.S. Core Complete, IP Core Complete, and enhanced (when additional crew are available).

The U.S. Core Complete configuration can support a strong program in ReMAP priority 1 physical sciences and commercial research. The IP Core Complete configuration can enable OBPR research in fundamental biology and fundamental physics. The enhanced configuration, adding crew, can advance OBPR's strategic research, as well as the ISS partnership, to realize the full potential of the ISS as a research platform.

Ms. Kicza recapped the research plan development status as of November 2002 through February 2003 and outlined the OBPR strategic plan. The Code U interdisciplinary strategy is divided into three themes, each updated every 3 years: the Biological Research Theme, the Physical Research Theme, and the Commercial Research Theme. The research plan and enterprise strategy generate research emphasis and associated roadmaps. Annual research solicitations yield flight experiments. Annual decision rules and utilization planning result in flight experiment priorities, which are given to tactical planners, for a 2- to 6-year planning window.

ISS Utilization Management

Congressional mandate calls for NASA, after establishing a comprehensive management proposal, to enter into an agreement with an NGO for the management of ISS research. The White House wants to encourage cost-saving ideas through competition. Therefore, the ISS Utilization Management Concept Development Team was formed in March 2002 with representation from every center with a role in ISS utilization. This non-profit NGO will perform research leadership functions, i.e. implementation, including significant aspects of research planning, research payload manifesting, resource allocation, advocacy, outreach, and archiving; selection of research and health and safety of the astronauts would remain a NASA responsibility. The NGO will report to NASA. NASA's Space Telescope Science Institute provides a successful model, however, they are looking into the guest researcher model. Ms. Kicza expects this institute to be a strong partner and a leader in optimizing and utilizing the Space Station. A two-phase contracting approach (meaning two competitions, one for the S/T/C leadership focus and another for the utilization function) is being recommended for the institute.

ADMINISTRATIVE PERSPECTIVE—Mr. Sponberg

OMB's mission is to prepare the President's budget and provide objective analysis and oversight of government management practices. They have no vested interest and try to remain politically neutral, presenting the pros, cons, and true costs of proposals that affect the budget. Then they carry out decisions according to sound management practices.

In the FY 2003 federal budget of \$2,229 billion, R&D accounts for \$123 billion; S&T, \$59 billion; NASA, \$15 billion. The 2004 budget has two priorities: safety and strengthening the economy. The federal deficit is about \$300 billion because, for the first time in history, we had a decrease in revenues 2 years in a row; additional investments in homeland defense; investment in Medicare; and spending for education, veterans, homeowners, AIDS initiative, and health care for the uninsured. However, historically the deficit is not large, although federal spending has been growing faster than family income. The goal in 2004 is to hold overall spending at 4% to equal the expected growth in family income.

Non-discretionary spending, which would require a change in the law to alter, comprises Social Security (21%), Medicare and Medicaid (19%), other mandatory spending (16%), and interest on the federal debt (8%). Discretionary spending accounts for 48% of the budget, of which defense discretionary is 17% and

non-defense discretionary, including NASA, is 19%. In relation to other agencies, NASA's budget is in the middle, below Defense, HHS, Education, HUD, VA, Homeland Security, Energy, Agriculture, and Justice, but above Labor, Transportation, Treasury, Interior, State, EPA, SSA, Commerce, Judicial Branch, and NSF. The United States spends more on R&D than Russia, Canada, Italy, the United Kingdom, France, Germany, and Japan combined. R&D funding was increased 10% over the 2003 request. Of the \$123 billion allotted to the five large R&D agencies, NASA received 9%; the other four were NIH (23%), Energy, NSF, and Defense.

This administration is results-oriented, guided not by process but by performance. They introduced Program Assessment Rating Tool (PART), the most sweeping assessment of federal programs—234 programs, representing \$494 billion. Of the 234 programs, 32 are R&D. The ratings are a budget tool but not the only tool for the decision process. Sets of questions used can be found on the OMB Web site. Examples of ratings are: Mars Exploration, effective; Space Station, results not demonstrated (the GPRA was a deficiency); Space Shuttle, moderately effective. Analysts expressed concerns about long-term planning and the rigor of the planning that went into the process. Criteria for all R&D (Code U programs) came from NAS studies:

- relevance—Why?
- quality—How?
- performance—How well?

These criteria allow prospective planning through retrospective assessment. A program must have complete plans, with clear goals (vital for code U) and priorities. (ReMAP did not set out clear goals.) Programs must articulate the potential public benefits. The Human Research Initiative is a good goal for Code U. Code S is a good model for strategic planning. Programs must define appropriate outcome measures, schedules, and decision points. NASA has tended to shy away from outcome measures because it's hard to predict discovery. Now the focus is on green, yellow, or red evaluations, which are qualitative, not quantitative.

NASA is second largest S&T agency (NIH is first). Of the \$59 billion in the budget for S&T, 17% goes to NASA; 10% to NSF; 10% to Energy; 9% to Defense; and 54% to NIH. This reflects a 5% increase for NASA this year (10% increase for NSF). NASA's new structure reflects its new strategy. Compelling questions drive exploration in NASA's 2003 strategic plan—"NASA will continue to expand its human presence in space—not as an end in itself—but as a means to further the goals of exploration, research, and discovery." This implies that science will drive the agency in the future.

The 2004 budget request is for \$15.5 billion; Code U research is a big chunk of the NASA budget, including: BPR 6%; space station 11%; space shuttle 26%; other SAE 43%; other SFC 14%. An important question is whether to fund the space station or other research for Code U projects. Much criticism comes from confusing the BPR with the Space Station and Space Shuttle (the two programs are tied together). It is critical for NASA to be able to demonstrate to the public and to the research community the value (tangible results) this research brings. It makes smart management sense to think about these programs more holistically. The NASA budget trend is steadily increasing from about \$13,750 million to about \$180,000 million, from 1998 to 2008. The NASA "earmark" trend has been almost asymptotic between 1996 and 2002. (In 2002, 140 earmarks totaled more than \$500 million.) This trend is worrisome because the net result is that it takes dollars away from programs that are being openly competed. White House decision makers lose interest in heavily earmarked programs because these programs imply no political influence.

The 2003 budget amendment, among other things, boosted space station reserves, revised the integrated space transportation plan, coordinated the decision path to improve access to the Space Station and maximize science return, and funded the Space Shuttle's service life extension program (\$1.7 billion over 5 years). However, OMB is just beginning to deal with budgetary aspects of recovery of debris from the *Columbia* disaster. The 2004 budget maintains the revised ISTP and maintains the 2003 plan, realigning commercial programs across the agency. Marketing NASA technology is questionable. Technology transfer should be treated as a normal part of doing business, avoiding set-asides. The government role of Space Product Development is being questioned because of limited access to the space environment. Activities at the former CSCs should be more closely aligned with strategic objectives over the next couple of years. Allocation of Space Station resources presents more of a problem: e.g., commercial research will be

conducted on the Space Station, but should the taxpayer be paying for the research someone else will profit from? In conclusion, we'll invest in those areas that further NASA's strategic interest. The 2004 building blocks are: the Project Prometheus (\$3 billion over 5 years); nuclear-electric propulsion and nuclear power for revolutionary science-driven exploration; Jupiter Icy Moons Orbiter; optical communications (\$0.3 billion over 5 years); a many-fold increase in data, including video capability; the Mars Exploration Program; and the Human Research Initiative (\$0.3 billion over 5 years), which is a critical investment if we are to get beyond Space Station.

Discussion

Ms. Porter opined that government should focus on basic and applied research that no one else will do. But, relevance is one of the criteria—is it in the government's interest to invest in this? If a program fits NASA's strategic plan, it will be funded. Dr. Sanders cited DARPA as an analogous example a couple of years ago. The reason no one else was putting money into this was that if private industry didn't know whether there would be a purchaser, it would cost them less to let the government develop the product and then sell it back to industry. Dr. Bula pointed out the importance of milestones; establishing them is just as important as establishing goals, because without them you can't judge whether you're making progress and then make appropriate adjustments.

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During lunch Dr. Peter Cavanaugh spoke on his flight research on exercise countermeasures and showed a video on preventing astronauts' bone loss through physical exercise.

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FULL-COST ACCOUNTING—Ms. Erickson

First, there's been a strategic shift toward exploration. In accordance with the agency's vision and mission, 18 themes have been established across the agency. Most are research-based rather than capability-based. The second significant shift is the one to full-cost accounting, budgeting, and management. Full-cost accounting is retrospective accounting (done since 1998). Full-cost budgeting means that the budget appears bigger because instead of the direct procurement budget, it includes direct procurement + overhead + benefits and travel associated with pools of employees. This switch is an attempt to adapt industry budgeting methods to government. At present, project managers have control of only about a third of their budget. Full-cost management will allow managers to control the whole budget, which should give them more flexibility and control. Some constraints remain to be dealt with, e.g., "direct project" is 2-year money, but "personnel" is 1-year money. The two accounting systems will run concurrently until everyone has implemented the new system.

Discussion

This is the way university-sponsored grants work. In the corporate world they go to full-cost analysis to evaluate whether they're getting what they pay for. This method will put pressure on NASA to eliminate underused facilities, because when a program terminates, those who remain will still have to pay for the center space and facilities.

DIVISION REPORTS

SPACE PRODUCT DEVELOPMENT—Ms. Livingston & Mr. Nall

The question, according to Ms. Livingston, is how to get from the previous philosophy of accounting, to the present philosophy. Now SPD is a separate division, but one with only five people and several vacancies. Its budget will be reduced from \$31.7 million in 2004 to \$15.7 million in 2008; with full-cost, \$15 million may mean only \$8 million or \$9 million in old budget terms. They need a reasonable way to phase things out. They are asking owners of the questions to include SPD. Examples of returned or completed SPD

research on ISS are ZCG, PGBA, and CGBA. Future SPD ISS payloads are planned for two missions, each with a few payloads, for increments 7, 8, and 9. Ms. Livingston concluded with seven examples of SPD and CSC research partnership.

Mr. Nall distributed a map locating research partnership centers and gave examples of products under development that support NASA's mission, but that also have commercial application, including: osteoprotegerin (to prevent calcium loss), high-definition TV, high-speed gyros, solar cells, nano particles, closed-system life cycle studies, star trackers, and hyperspectral imagers. In addition to the dual use of the research is dual use of the hardware. Numerous facilities have been made available to Shuttle and ISS payload users. With marketing development, corporations are getting an idea of what can be done in space, which is creating an emerging market. Putting the two together extends commerce into space. You can't achieve the long-term goal if you have to fund and own every piece of the project; commercial partnerships help create sustainable exploration.

Discussion

Dr. Baldwin thinks something needs to be said about the budget reduction in SPD, either as a protest statement or as a recommendation, by this committee. Ms. Porter pointed out that, in a policy change, whether it's fairly applied is often irrelevant. E.g., all industrial research was to be eliminated, even the good programs, to fit with new ideology. So SPD is now going through 60-some product lines to show how each affects NASA's strategic mission. ("To improve life on earth" does not extend to providing jobs.) The savings in hardware construction that can be achieved with partnerships can be substantial and must be highlighted. Because these centers have been interdisciplinary, many don't belong to a particular area.

MISSION INTEGRATION—Mr. Ahlf

NASA should plan according to hardware development, not to shuttle schedules. The Mission Integration Division is looking at research programs that don't require large up-mass. They are not planning for projects that require human subjects. They must be ready for option 2, but plan for option 3. Option 4 was selected at HOA in Japan. They will try to use current stations. Crew size will be increased in 2006–2007 by making use of existing crew with two *Soyuz* at all times; while it allows more flights, this will demand an increase in crew support. The Free Flyer Study was begun in early 2002 to study science requirements and technical options to increase OBPR's access to space. Research may be international, but the program itself will be NASA's, like the Russian program buy-ins.

The glovebox can be justified with a crew that's reduced from six to three because it's intellectually stimulating and very popular among crew members. Studies on STS-107 that routinely sent data back as collected acquired 50 to 90% of data, but we don't know about objectives met. Most of the biological studies depended on samples collected at the end of the flight—all that was lost. Status of the ISS research flight hardware is: 7 research facility racks on-orbit in the U.S. laboratory; 70 investigations are complete or underway; 6 additional racks are ready to launch; 4 express transportation racks have been completed; and 7 additional research facilities are under development. Increasing crew time will increase the amount of work the crew can do. The ISS Payloads Office improvement process by: reengineering mission integration process and incorporating significant improvement in payload re-flight integration; developing a cross-functional data management function to identify and eliminate unnecessary and duplicative inputs; clearly defining end-to-end integration process communicated through customer-friendly information sources and the Web site; and strengthening Payload Integration Manager role. They also want to ensure customer satisfaction through a well-established customer feedback cycle. The help desk is scheduled to be completed by April. To ensure accountability, one group should be responsible for an entire process. Mr. Ahlf concluded with a list of action items and their targeted completion dates in 2003. In order to identify and prioritize the areas within the ISS/SS utilization system most needing change, a reinvention team, chaired by Rita Willcoxon, has been formed and is meeting every other week.

PHYSICAL SCIENCES RESEARCH—Dr. Trinh

The National Research Council has reviewed and endorsed the OBPR Physical Science Research program. The program has been prioritized and resource re-allocations have been carried out. A feasible ISS flight research program has been formulated for 2003–2007. The current ISS research program will be strengthened starting 2005 by using discipline-dedicated research facility racks; this involves deploying systems that have already been in development. Research re-planning has begun, which will increase ISS research utilization. The PSR program integrates the cross-disciplinary requirements of the NASA and OBPR strategic objectives

PSR sees their program as a dual thrust focused on strategic research for exploration, and fundamental and applied research. A big change is the redirection of research goals to exploration of space. Four research areas are gradually being phased out; two were assigned lower priority by ReMAP; microgravity research is a high priority. Missions are now being designed by scientific directors. PSR lost a combustion module on STS-107, but the effects of that won't domino to ISS.

To address the goal of educating and inspiring the next generation, PSR wants to establish a presence in the non-peer reviewed literature, e.g., *Science News*, the *New York Times*'s Science Times, *Scientific American*. However, Dr. Bula pointed out that although these publications may be well regarded, they are not of use in space exploration.

Discussion

Dr. Faeth said, "Exploration of space implies exploitation of space. Space is an enabling lab facility for research that can't be achieved on Earth." Human biology cannot be completely studied on Earth, said Dr. Borer, because of gravity; space research allows a non-gravity-influenced control. Dr. Jessup noted the NRC report's very specific recommendation regarding protein crystal growth. According to ReMAP, that has not yet been done; it is to be emphasized in the next 2 years.

BIOASTRONAUTICS RESEARCH—Dr. Fogleman

Dr. Fogleman noted that Johnson Space Center had brought on Frank Saulsman for the Radiation Program, and that the National Space Biomedical Research Institute had lost Dr. Ron White, who left the institute February 3. Dr. Fogleman distributed the final, January 27, 2003, Bioastronautics Strategy. Bioastronautics Research focuses on specific outcomes to ensure that the human is not the limiting factor for long-duration space flight. It aims to provide answers to two key organizing questions:

- How can we assure survival of humans traveling far from Earth?
- What technology must we create to enable the next explorers to go beyond where we have been?

Since ReMAP they have been further strengthening and focusing the Biomedical Research and Countermeasures Program and assessing and strengthening the Advanced Human Support Technologies Program. Their approach is DARPA-like using Rapid Development Technology Teams. The Human Research Facility Rack 1 has been on board ISS for nearly 2 years and experiments are ongoing; Rack 2 was installed and is ready to launch. The Human Research Initiative promises to deliver on schedule, if given a larger crew and shorter increment durations.

A facility for bed rest ground analog studies at the University of Texas Medical Branch's General Clinical Research Center has been completed. There is a facility in France, but NASA will only collaborate with them and is not planning to conduct all bed rest studies in Europe. First, Bioastronautics Research must see what the demand for bed rest research is, some of which depends on whether this Human Research Initiative is funded. In addition to Human Research Initiative, a number of focused initiatives are expected.

Discussion

According to Dr. Borer, bed-rest facilities model few things other than microgravity. The facility in Galveston is an NIH burn facility; half the beds (5) are for NASA, and the rest are for NIH to study

nutrition, gerontology, etc. The question is which is the best deal for NASA? NASA may need to revisit the numbers.

The NASA Space Radiation Laboratory (NSRL) is scheduled to open at the Brookhaven National Laboratory in July 2003. The NASA/AIMS Research Center has one of the best facilities, but NASA is joining forces with an outside facility, as dictated by a business decision based on projected needs. Dr. Merrell believes the era of the AIMS facility has passed—the Bevel Act (radiation research) closed in 1994—and that the opening of radiation facility is cause for celebration.

FUNDAMENTAL SPACE BIOLOGY—Dr. Liskowsky

The FSB's proposed roadmap is modeled on Astrobiology and other OSS roadmaps. Their focus is on goals relevant to the bioastronautics program as well as Space Architect. The program is divided into R&T (ground research, flight research, and part of the Radiation Health Initiative) and ISSRC (establishment of ISS reserves, fund SSBRP core, fund phase I of Advanced Animal Habitat and Plant Research Unit, and ISS utilization). They have been reviewing and funding research proposals in space life sciences, fundamental space biology, and ground-based research, and have solicited proposals for 2003. Other activities include convening working groups, meetings, and workshops. Research projects are planned through October 2004 on STS-115, STS-117, STS-121, and Increment 10. The most significant staffing change for FSB is that Terri Lomax has been appointed the new director.

BIOMEDICAL RESEARCH ISSUES—Dr. Davis & Dr. Williams

Issues—Dr. Davis

Three offices—the Office of Space Flight, the Office of the Chief Health and Medical Officer, and the Office of Biological and Physical Research—work collaboratively to ensure the safety, health, and optimum performance of astronauts through the systematic identification and management of critical risks associated with space travel. Three goals were established—managing risk, increasing efficiency, and returning benefits to Earth. Critical risks were identified and their impact assessed; then acceptable levels of risk were established and a cost/benefit analysis applied to them. The requirements for crew health, safety, and performance have been written.

Clinical status evaluation is a standardized battery of clinical, physiological, and psychological tests performed on each long-duration crew member. Biomedical Research will standardize the data they collect and share it with international partners. They have developed a risk-based plan for pre-flight, in-flight, and post-flight requirements, and they will move on to a tactical plan. The importance of this document is the opportunity it affords to tie together all aspects—biomedical, policy, etc. They want to move to outcome-driven results. From dates they have for human exploration, they will back out objectives, etc. Their roadmap is based on the Critical Path Roadmap, which they will adapt as they go along.

Discussion

Dr. Gross thought that with full-cost accounting, the strategy may be funded through Code M, and that as a countermeasure gets to higher and higher levels, it has to be built into the budget process to be part of flight hardware. Now everyone sees how it fits into the grand scheme. Dr. Merrell noted the huge amount of cooperation between NSBRI and other agencies. IOM objectives have been answered—things have never been this good. Dr. Williams and Dr. Davis want to institutionalize this so that it becomes a way of doing business.

Longitudinal Study of Astronaut Health—Dr. Williams

The Life Sciences Data Archive (LSDA) is a historical archive of flight data beginning with 1961. Its objective is to preserve and make accessible to the scientific community NASA science data and information obtained from Code U–sponsored space life sciences investigations. LSDA has a Web site, which can be searched to a limited degree, but much of the data is protected for privacy. Dr Schneider said they paid for Russian data some years ago, but got mostly what was available in the published literature. They have a plan to capture longitudinal and prospective data, but standardization across international lines will facilitate that data gathering.

“Astronaut” may be one of the most dangerous professions. Radiation exposure is a particular concern. Astronauts appear to suffer increased incidence of cataracts, thyroid problems, cancer, and death, but, so far, data have been collected by clinicians who think they notice a trend. The Longitudinal Study of Astronaut Health collected clinical data from each astronaut’s selection throughout his or her life. (As of March 2000, 295 astronauts had been selected and 222 of them had flown in space.) The purpose was to examine the mortality and morbidity rates of astronauts as compared with a group of civil service employees; to determine the rate of illness and accidents that require medical care; and to establish a comprehensive database that will facilitate investigations of health issues. NASA has asked a standing committee of the IOM (people who have no vested interest) to evaluate the LSAH in its current configuration and to recommend ways to improve the study, specifically to address potential relevance of lessons learned from historical exposures with regard to usefulness in identifying health risks; and to evaluate feasibility of astronauts/cosmonauts participating in the LSAH studies about medicine in NASA.

The medical profession’s role further extends in a *Columbia*-type disaster to aiding crew recovery efforts, facilitating support for families, handling the debris field, and dealing with the emotional aftermath. They are dealing not only with the families of the astronauts who died on *Columbia*, but with the families of crew members on the space ship in orbit. The Code U community of investigators is also one of the vulnerable populations.

EDUCATION OUTREACH UPDATE—Ms. McClain

Education, a Code N enterprise, represents 23 different areas. The OBPR Educational Outreach mission is to communicate the enterprise’s unique space research to inspire achievement of academic excellence, to influence choice of science, math and technology careers, and to increase the scientific literacy of our nation’s citizenry. Their four major priorities address NASA’s strategic goals 6 and 7. They are: to motivate students to pursue careers in science, math, engineering, and technology; to provide educators with teaching tools and experiences; to seek to ensure that taxpayer’s resources are invested wisely; and to engage minority and underrepresented students, educators, and researchers in NASA’s education program. Their major strategies are expanding the pool of pre-college students entering the STEM pipeline (primarily K-12), and increasing the number of persons entering the STEM workforce (post-secondary). Education Outreach has matched the Code N goals and priorities with the appropriate Code U support. Their roadmap extends from 2002 to 2016. The Educator Astronaut Program is the Administrator’s signature education initiative, through which they invite and select a diverse group of educators, who have been teaching in the classroom within the last 2 years, to join the astronaut corps.

The educational projects coordinated with the research conducted on STS-107 serve as a model for what could be done with ISS. Students from 37 schools in 9 states and 8 countries were involved to varying degrees. About 140 students, educators, and parents attended the launch. The suite of educational activities and experiences devised has potential for reaching thousands of students, educators, parents, and members of the general public. Ms. McClain cited letters of support students wrote after the *Columbia* disaster to indicate that the program is in fact inspiring students.

Discussion

Dr. McPherson observed that one of the best things about the program is how inspiring it is; one of the worst things is how few people you can reach—300 explorer schools is a drop in the bucket. He opined that you have to find your best targets to maximize your resources.

PUBLIC OUTREACH UPDATE—Ms. Beasley

The message NASA wants the public to know is:

- ISS is a unique research facility, and
- NASA is working in space to make life better on Earth, and to make it possible for humans to further explore our solar system.

Everyone at NASA already knows about the importance of public affairs and why it's important to get our message out. Therefore, Ms. Beasley needs to know what's going on. More photos and animation would help publicize space research. The Marshall Space Center used to put out reports every week. Now Headquarters puts out reports as needed to tens of thousands of people. For the STS-107 mission activities, Ms. Beasley restructured the JSC briefings so that Roger Crouch did 24 live shots, all talking about the science. Because of the importance of the overall mission and the science, they produced a media tip-sheet so news people could talk about the science. During the mission they got wonderful coverage of science. In the STS-107 aftermath Public Affairs' strategy was one of openness (unlike 17 years ago). There were 1800 reporters at Johnson (now there are 300), and news releases are going out about what we've retrieved from STS-107. By 12:30 February 13, the *Columbia* Web site had had 350 million hits. NPR wants to do a call-in show February 14 at noon with Bob Park, a reporter from the *Baltimore Sun*, and Joshua Zinburg from NIH. In response to our poor preparation for distributing basic information to the public after the disaster, Public Affairs has compiled a "Message Book," a resource for getting the word out to the media and to other people. The book is prepared in "sound bites" and is a dynamic document that will be continually updated. Public Affairs is also putting together an overall strategic communications plan.

February 14, 2003**INTERNATIONAL SPACE STATION RESEARCH STATUS—Dr. Pellis**

Experiments continue as capacity increases to accommodate more individual investigations and more disciplines in science. Despite significant challenges, the importance of research is playing an increasing role in programmatic decisions, and answers to the scientific questions are beginning to be published. Processes are under development to measure the success of ISS research and to identify the highest-priority research while maximizing the scientific return from ISS. Applying this process should result in the highest scientific return from OBPR's and NASA's investment in resources. New investigations center on the chromosomal aberrations in response to ionizing radiation, the foot, muscle and bone loss, protein crystallization in microgravity, coarsening in solid liquid mixtures, the structure of magnetorheological fluids in the pulsed magnetic field (InSpace), and the zeolite crystal growth furnace. Results are being collected and analyzed on the following: the effect of microgravity on the peripheral subcutaneous veno-arteriolar reflex in humans (Xenon1), solidification using a baffle in sealed ampoules (MSG/SUBSA), advanced astroculture (ADVASC), plant generic bioprocessing apparatus (PGBA), and microencapsulation electrostatic processing system (MEPS). Major research accomplishments are: the first experiments flew to ISS in September 2000; research in the international radiation suite has been continuous since March 2001; nearly 1200 crew hours have been spent on 70 investigations; five research racks are on-orbit. The Office of the Program Scientist has been defined to oversee ISS research.

The office functions like the dean of a school: everything that comes to them is meritorious and they must assign priority. To deal with the provocative issue of how to measure performance, the office is developing an integrated plan. Enabling impacts are significant, but can't be determined until after the fact, e.g., the genome project enabled things unknown when the technology was developed in the 1960s. It's important to couple decision rules to performance evaluation, although decision rules apply at the tactical level. The rules center around: ReMAP priority, strategic value, platform, scientific return, terrestrial application, timeliness, readiness for flight, and vehicle resources required. A statistician is now working on a way to weight the decision rules, which they want to create in such a way as to prevent gaming. When this stage is finished, they want to remand it to a group of physical, commercial, biological, and bioastronautical sciences—probably five people—for review and suggestions. The next step is to get a task force to flesh out this concept; they would like to have understanding of the process by June. BPRAC will provide immediate feedback via e-mail and can put a sounding-board together. The division director with the PI will give a two-page summary (with back-up material if necessary) incorporating answers to questions in

the decision rules. There could be 30 or 40 of these per year. These rules will be invoked using an extramural panel (sought from leaders in science, rather than PIs—people who understand the issues) to guide the rules. But process cannot be blindly and mutely administered; an element of inspired choice is necessary. Even assigning a number implies subjective choice.

2003 OBPR STRATEGIC PLAN DEVELOPMENT

STRATEGIC PLANNING STATUS—Mr. Flaherty

The structure of the NASA strategic plan is a six-layered triangle. Topmost is vision, followed by mission, agency goals (10), themes (18), objectives (some 60), and implementing strategies. Roadmap development is the key activity. The content of each roadmap will flow up into the agency structure. The strategic plan was released February 3. The integrated space plan is in development, and the BPR enterprise strategy is in development through September 2003 and will be finalized for release in February 2004. The OBPR research plan has been released in draft. Question roadmaps are in development through September 2003. The integrated budget and performance document has been completed for FY04, and they're about to start development for FY05.

THE ORGANIZING QUESTIONS—Dr. Ross

The OBPR research plan is being prepared in compliance with congressional direction. The NASA task force recommended that OBPR structure their research plan around organizing questions (see page 5 above). OBPR should perform research that facilitates the decision of whether and when we go beyond LED. Our immediate job is to prepare for that extension and hasten the journey. This is what led to the Human Research Initiative. Dr. Baldwin pointed out that these are the defined questions for OBPR, not for the rest of the agency. The committee wants a one-page explanation of where OBPR fits in and what the distribution of resources is for each question.

Reviewer feedback (14 written responses) was overwhelmingly positive—10–11 really liked it, 2 were very negative, 2 were neutral. The Commercial Subcommittee thought they were not adequately represented, and there was some fear that curiosity-driven research would become passé. Changes were incorporated into the draft. Specifically, question 3 is being refined to consist of five sub-questions:

- 3a: How does the space environment change the behavior of physical and chemical processes and the technologies that rely on them?
- 3b: What can we learn about the organizing principles from which structure and complexity arise in nature?
- 3c: Where will space research advance our knowledge of the fundamental laws governing time and matter?
- 3d: What are the fundamental physical, chemical, and biophysical mechanisms that drive the cellular and physiological behavior observed in the space environment?
- 3e: How can we create research partnerships that support national goals, such as contributing to economic growth and sustaining human capital in the areas of science and technology?

More detail is being incorporated into the physical sciences research organizing questions:

- 1. How does the space environment change the behavior of physical and chemical processes and the technologies that rely on them?
- 2. What can we learn about the organizing principles from which structure and complexity arise in nature?
- 3. Where will space research advance our knowledge of the fundamental laws governing time and matter?
- 4. What are the fundamental physical, chemical, and biophysical mechanisms that drive the cellular and physiological behavior observed in the space environment?

The research plan should be finalized by the end of February. Criteria for the decision-making process are still being decided. The research plan should result in an integrated, executable roadmap, that is, a strategic

allocations process. The decision rules will be used to implement roadmaps. This is complicated by each NRA having its own schedule and time frame, and by the quantity of projects in the existing queue.

Quantitative Metrics for OBPR

We should be asking, not “Did it work?” but “What did we learn?” To do this, we need to create a robust set of quantitative metrics by which to monitor and assess our own performance. Such quantitative metrics may be categorized as program performance, and implementation or management performance. The proposed metrics are only one tool for assessing aspects of the OBPR program. Fundamental and applied research productivity can be judged by receipt of awards, publications, patents, licenses, requests for data or reports, etc. Strategic research products may be judged by whether countermeasures are being adopted, mass reductions are enabled, or volume reductions are enabled. Another consideration is how we normalize the criteria—per dollar, per investigation. Metrics will be drafted in June and finalized in September. We will need a sounding board of about five people to work out just how these metrics relate to decision rules and to the NRA evaluation criteria.

ENTERPRISE STRATEGY—Ms. Guerra

The goal is to produce a single document, the OBPR Enterprise Strategy, which expands the OBPR research plan and which will be updated on a 3-year cycle in accordance with the NASA strategic plan. Each organizing question, including its sub-questions, was assigned an owner: questions 1 and 4, Dr. Fogleman; question 2, Dr. Liskowsky; question 3, Dr. Trinh; question 5, Ms. McClain. They will grapple with a bottoms-up approach to developing a roadmap, during which they are encouraged to work with their research community and other OBPR divisions. The Commercial Advisory subcommittee would like cross-disciplinary input. Splinter sessions will present their review of each particular science to the full group. The whole group will also hear feedback from the NRC (the outside community). The Enterprise Strategy draft will be finalized by August and submitted to OMB in September.

PHYSICAL SCIENCES PROGRAMS—Dr. Trinh

Physical Sciences proceeds in two thrusts: strategic research for exploration, and fundamental and applied research. The current plan incorporates five disciplines. In addition to a basic research roadmap, physical sciences has added a technology roadmap for 3 subdivisions—bioengineering and biotechnology, applied physical sciences, and fundamental physics. Research themes will be the guiding principle. Each research theme (e.g., low-temperature atomic gravitational physics) will have a roadmap, developed on a 5-year horizon through technical workshops and the Discipline Working Groups; most will involve interdisciplinary efforts. The organizing questions are not equal in scope or emphasis. Microgravity research enables major progress in question 3. Question 4—What are the fundamental physical, chemical, and biophysical mechanisms that drive the cellular and physiological behavior observed in the space environment?—is the lynchpin between the biological and physical sciences and should be re-worded to communicate the dual focus. A first outline of the research plan will be ready February 2003; the first draft, April 2003; the second draft, July 2003.

FUNDAMENTAL SPACE BIOLOGY—Dr. Liskowsky

The FSB roadmap will focus on both strategic and fundamental research, incorporating the impact of all five organizing questions. The proposed structure for FSB is modeled on Astrobiology and other OSS roadmaps. They plan to work closely with the Bioastronautics Division in trying to define and focus fundamental research to areas where they think they can have an impact. Sub-questions could serve as goals; under each would be objectives and then fundamental research areas. By June they want to have completed the program impacts analysis. They have begun developing key thrust areas of investigator-driven research. From the draft fundamental biology technology roadmap, which is nearly complete, they will insert technology enablers. In addition to enabling technologies, they will begin (March 2003) to overlay mission capabilities. In April they will send the draft document to the community. The Fundamental Biology Roadmap Workshop will be held May 6–8, 2003, and the roadmap will be completed by June 2003.

CODE U ENTERPRISE STRATEGY, QUESTIONS 1 & 4—Dr. Fogleman

Dr. Fogleman will get a draft to the committee before the June workshop. Other people will look at later drafts via e-mail and telecoms. He would like to have a small workshop in early April. The first draft will devote about 20 pages to each question. Draft 1 will be ready in March 2003; draft 2, at the end of April; and draft 3, in June.

Question 1—How can we assure the survival of humans traveling far from earth?—has been subdivided as follows:

- 1a: What knowledge and tools are needed to enable the practice of medicine in space?
- 1b: What do we know about how the human body and its physiology adapt to space flight, when is it appropriate to counteract those adaptive effects, and by what means can we do so?
- 1c: What is needed to protect human space explorers from the cosmic radiation that bombards their spacecraft and their bodies?
- 1d: How can we provide an optimal environment to support behavioral health and human performance in space flight?

Question 4—What technology must we create to enable the next explorers to go beyond where we have been?—has been subdivided as follows:

- 4a: How can we change spacecraft systems to lessen the required up-mass, volume, power, and crew time?
- 4b: How can technology help human productivity and well-being during extended isolation from Earth?
- 4c: How can we ensure that the crew is living and working in a safe and comfortable environment?
- 4d: What is the optimal way to support medical care of crewmembers for extended space flight missions?

Question 4 needs additional language to make people understand the emphasis on keeping the crew alive; “advanced life support” is meaningful to people in NASA, but not to others. Many parts must be integrated cooperatively across all enterprises, but the synthesis process comes at the end. Possible metrics are risk reduction, equivalent system mass, or increased crew time. Metrics would be general, specifics being applied within the discipline.

SPACE PRODUCT DEVELOPMENT—Ms. Livingston

If we are to show the value of our program to NASA, we must understand NASA’s goal. If we can’t show the program’s value, we need a plan to ratchet down. CSC directors may want to use a “divide and conquer/win” method. They are to be an integral part of the roadmap process. Because business is part of the geography, we must find a way not to alienate business, no matter what happens within NASA’s internal politics.

CONCLUSION

Dr. Jessup strongly commended the presentations, but noted that at NASA meetings, presenters always spend about 40% of their time explaining reorganization charts. It would be nice if we could “fence it” so we can get on with the job. Dr. Borer thought the greatest rap against the life and microgravity sciences is that they don’t speak with a single voice and they have no clear objectives. However, over last two days he heard verbalization of a plan that sets forth a suite of community ideas that will counter this criticism. Ms. Porter praised Mary Kicza as the absolute model of a public administrator—she understood the programs, listened to people, got people together, and did it all in a short time.

The meeting adjourned to consider the findings and recommendations that committee members had drafted the night before.

Appendix A. Agenda

BIOLOGICAL AND PHYSICAL RESEARCH ADVISORY COMMITTEE MEETING
 NASA Headquarters
 Washington, DC
 February 13-14, 2003

Thursday, February 13

9:00 A.M.	Welcome/Chair's Review of Agenda/Logistics	Dr. Baldwin
9:10 A.M.	Review of BPRAC Recommendations	Dr. Carpenter
9:20 A.M.	OBPR Program Overview	Ms. Kicza
10:30 A.M.	Administration Perspective	Mr. Sponberg
12:00 P.M.	Lunch (research presentation by Peter Cavanaugh)	
1:00 P.M.	Division Directors' Reports Space Product Development Mission Integration Physical Sciences Research Bioastronautics Research Fundamental Space Biology	Ms. Livingston Mr. Ahlf Dr. Trinh Dr. Fogleman Dr. Liskowsky
4:00 P.M.	Biomedical Research Issues	Dr. Williams & Dr. Davis
5:00 P.M.	Educational Outreach Update Public Outreach Update	Ms. McClain Ms. Beasley
6:00 P.M.	Adjourn	

Friday, February 14

8:00 A.M.	International Space Station Research Status	Dr. Pellis Mr. Ahlf
8:30 A.M.	2003 OBPR Strategic Plan Development	Mr. Flaherty Dr. Ross Dr. Trinh Dr. Liskowsky Dr. Fogleman Ms. Livingston
11:00 A.M.	Review of Issues, Findings, and Recommendations	Dr. Baldwin
12:00 P.M.	Adjourn	

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Appendix C. Meeting Attendees*Committee Members:*

Baldwin, Kenneth (Chair)	University of California, Irvine
Bigelow, Nicholas	University of Rochester
Borer, Jeffrey	Cornell University Center
Bula, Raymond	[not affiliated]
Carpenter, Bradley (Executive Secretary)	NASA Headquarters
Daley, Thomas	Philadelphia Naval Business Center
Faeth, Gerard (Vice-Chair)	University of Michigan
Gross, Leroy	INTEL MED Inc.
Jessup, J. Milburn “Kim”	Georgetown University Medical Ctr
McPherson, Alexander Jr.	University of California, Irvine
Merrell, Ronald	MCV-VCU
Porter, Elsa	Meridian International Institute
Sanders, Jay	Global Telemedicine Group

NASA Attendees:

Ahlf, Peter	Mission Integration Division
Beasley, Dolores	Public Affairs
Davis, Jeffrey	Bioastronautics
Erickson	OBPR, NASA Headquarters
Flaherty, Chris	OBPR, NASA Headquarters
Fogleman, Guy	Bioastronautics
Guerra, Lisa	OBPR, NASA Headquarters
Kicza, Mary	OBPR, NASA Headquarters
Liskowsky, David	Fundamental Space Biology Division
Livingston, Candace	Space Product Development
McClain, Bonnie	Educational Outreach
Pellis, Neal	International Space Station
Ross, Howard	OBPR, NASA Headquarters
Trinh, Eugene	Physical Sciences Research Division
Williams, Richard	Bioastronautics

Cavanaugh, Peter
Sponberg,

OMB

Appendix D. Findings and Recommendations**OBPR PROGRAM OVERVIEW****Finding:**

The Committee received a report on the current status of the OBPR program from Mary Kicza, Associate Administrator. The Committee received summaries of the current budget, including a succinct review of changes from the FY2003 budget to FY 2004 IMCE recommendations and OBPR responses current research priorities current status of OPBR strategic planning (including decision rules and the increment tactical allocation process), and current plan for ISS utilization management, based on creation of a NGO, including procedure for selecting among NGO format options recommendation of a non-profit institute format for the NGO, tasked with research leadership functions stipulation that selection of research projects will remain directly under NASA according to the current peer-review model procurement approach to entity/entities to be involved in NGO institute approach to a planned 6 month effort to identify and prioritize areas within the Shuttle, ISS and space station utilization programs most needing change.

The Committee was very favorably impressed with the detailed organization plan and well-defined decision-making processes now in place for management of the extensive OBPR mission. The Committee believes this organization and planning process is likely to maximize OBPR research productivity, and anticipates regular updates to elucidate the results of the process.

SPACE PRODUCT DEVELOPMENT BUDGET (for the NAC)**Finding:**

In the President's FY04 and 05 budget, the Space Products Development Program is targeted for realignment and severe funding reductions. If implemented, this would reduce the program by two-thirds and result in the loss of highly acclaimed university and industrial research partnerships and their assets built by NASA over the past 18 years. This program has been given exceptionally high marks by the BPRAC and was recommended by NASA to be sustained. The budget action appears to be driven by a shift in policy concerning public support of private industry.

Recommendation:

BPRAC urges the administration to take steps to prevent the loss of this significant public-private investment and its technological capabilities and assets, which serve NASA's strategic mission. BPRAC requests further briefings about the status of this program at its next meeting.

SPACE MEDICINE**Finding:**

The NASA bioastronautics program has developed a uniquely collaborative strategy that transcends Codes U, M, and AM. This has been codified in an innovative strategic plan and will be followed by a supporting tactical plan. Code U has embraced the priorities of ReMAP and Code M is guided by the critical pathway road map. Concurrently NASA is transitioning to a full cost accounting system that will impact current and future bioastronautics requirements.

Recommendation:

The BPRAC recommends the proposed tactical plan incorporate a structure process and outcomes that integrate ReMAP, CPRM, and the full-cost accounting program across the relevant codes. An update on progress being made in this laudatory effort is appreciated.

AEROSPACE MEDICINE**Finding:**

The IOM report on space medicine was received in November 2001. In the interim the Office of the Chief Health and Medical Officer in Code AM (Dr. Williams), the Office of Biological and Physical Research (Dr. Fogleman), the Office of Crew Health and Safety, Office of Space Flight in Code M (Dr. Davis) and Dr. Davis in his new role at JSC have worked in harmony and with creativity to implement substantive improvements to the organization, oversight and science planning for space medicine. The effort across three major divisions at Headquarters, the Johnson Space Flight Center, and the NSBRI have resulted in a collegial process with astronaut health, being the overwhelming priority. NASA is well on its way to full response to the IOM recommendations.

Recommendation:

BPRAC commends NASA for its vigorous response to the IOM.
BPRAC asks for occasional briefings from Dr. Williams and from Dr. Davis.
BPRAC requests the minutes from the newly constituted external advisory committee, the AMOHAC.

ISS & SPACE SHUTTLE STATUS & FUTURE**Finding:**

The committee lauds the Office of Biological and Physical Research for its efforts to realign research priorities to match the administration's vision and the ReMAP recommendations. The committee further recognizes OBPR efforts to prepare its flight research plan for possible rescheduling in the wake of the *Columbia* tragedy.

Recommendation:

BPRAC requests an update on the status of Code U research on the International Space Station and the Shuttle, including a report on the status of research on STS-107.

MANAGEMENT OF THE ISS AS AN NGO—(for the NAC)**Finding:**

The BPRAC applauds the OBPR for progress made to focus the form and role of the Non-Governmental Organization (NGO) for the ISS to be an Institute that assists in the management of the research to be performed on the ISS. The NASA recommended option is an NGO, specifically a not-for profit institute, to perform research leadership functions including significant aspects of research planning, research payload manifesting, resource allocation, advocacy, outreach, and archiving. This statement, however, does not provide a clear indication of the division of responsibilities between NASA Headquarters and the ISS-NGO with respect to managing the NRA process and selecting ground-based and flight investigations.

Recommendation:

* NASA still needs to articulate more clearly the division of research management between OBPR and the proposed ISS-NGO as well as with other research institutes involved with OBPR. The manner in which NASA Headquarters intends to handle the NRA and grant selection processes for ground-based and flight research is a particular concern.

* BPRAC requests further briefings about these issues at the next BPRAC meeting.

Appendix E. List of Presentation Material

Status of BPRAC Recommendations [Carpenter]
Program Overview [Kicza]
Themes [Erikson]
Space Product Development [Livingston]
Mission Integration Division [Ahlf]
Physical Sciences Research Division [Trinh]
Bioastronautics Strategy, January 27, 2003, final [Fogleman]
Bioastronautics Research [Fogleman]
Fundamental Space Biology Division Update [Liskowsky]
Bioastronautics Strategy [Williams & Davis]
The Longitudinal Study of Astronaut Health [Williams]
Educational Outreach Update [McClain]
Space Research and You—The Science of Shuttle Mission STS-107 [McClain]
Public Affairs & OBPR [Beasley]
The Message Book [Beasley & Ross]
International Space Station Science [Pellis]
ISS Contract Strategy Update [Pellis]
Strategic Planning Status [Flaherty]
The Organizing Questions, the OSBPR Research Plan, and Where We Go from Here [Ross]
The OBPR Enterprise Strategy General Background [Guerra]
OBPR Physical Sciences Programs Path to a Research Plan [Trinh]
Fundamental Space Biology Program Strategic Planning Status [Liskowsky]
Code U Enterprise Strategy, Question 1 & Question 4 [Fogleman]
Report of the Multilateral Coordination Board to the ISS Heads of Agency [Ahlf]
Innovation Catalyst Initiative [Pace]